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Accelerating perchlorate detection

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Although perchlorate testing is not yet required by law, researchers across the country are trying to characterize the extent of contamination by the chemical commonly used in solid rocket fuel. The task is growing easier now that a number of new methods of confirming the compound's presence are available.

As last year's perchlorate-in-fertilizer brouhaha illustrates (*Environ. Sci. Technol.* **1999**, *33* (19) [394A-395A](#)), having a number of accurate and reliable methods for detecting perchlorate is crucial for researchers testing groundwater and drinking water for contamination. Retesting of fertilizer samples at EPA's National Exposure Research Lab in Athens, GA, shows that perchlorate's presence is not as ubiquitous as previously feared (*Environ. Sci. Technol.* **2000**, *34* (1) [224](#)), but researchers there are still grappling with the issue. Most of the work assessing how regularly perchlorate is found in fertilizer is now taking place at North Carolina State University, but the EPA researchers are still investigating whether the compound can be taken up by food crops like lettuce.

The newest method for verifying perchlorate's existence was devised by three researchers from Lawrence Livermore National Laboratory (LLNL), who used it to ascertain the level of contamination at their California facility (*Environ. Sci. Technol.* **2000**, *34* (9) [1862-1864](#)). They used a special instrument that combines two quadrupole mass spectrometers, which identify ions like perchlorate by gasifying them, subjecting the gas to electric and or magnetic fields, and measuring how their path is diverted to identify their unique mass-to-charge ratio. "Our method based on tandem mass spectrometry offers a very high degree of specificity for perchlorate," said Harry Beller, an environmental scientist with LLNL. The technique can detect perchlorate to the low parts-per-billion (ppb) level, which is important because, although there is no national action level for the compound, California is collecting data on all sites containing more than 18 ppb of the chemical.

The LLNL technique joins a number of new methods based on mass spectrometry that have become available in the last year to complement the ion chromatography technique that EPA has officially approved for detecting perchlorate, said Ed Urbansky, a chemist at the agency's National Risk Management Research Laboratory in Cincinnati, OH. Urbansky helped develop one of these techniques; other notable methods were devised by researchers at Canada's University of Alberta and the U.S. Air

Force Research Laboratory, he said. The most unusual relies on a new instrument known as a high-field asymmetric waveform ion mobility mass spectrometer, which is being developed at Canada's National Research Council in association with instrument manufacturer Sciex. "Every one of these techniques is valid and works well," Urbansky said.

Although ion chromatography is good for screening for perchlorate's presence, the presence of other ions like sulfates can complicate the analysis, Urbansky said. Mass spectrometry which was not one of the methods used to verify perchlorate's presence in fertilizer by the EPA researchers in Georgia—provides an irrefutable identification based on a fundamental property of the compound, its mass, Urbansky said, noting that he wished such confirmatory methods were used more regularly in the drinking water industry.

In their paper, the LLNL researchers point out that, unlike the ion chromatography method certified for detecting perchlorate in California, their method is fairly "green" since it requires no toxic chemicals and generates no waste. But most of the other techniques for detecting perchlorate now available also consume a minimum of toxic ingredients, Urbansky said.

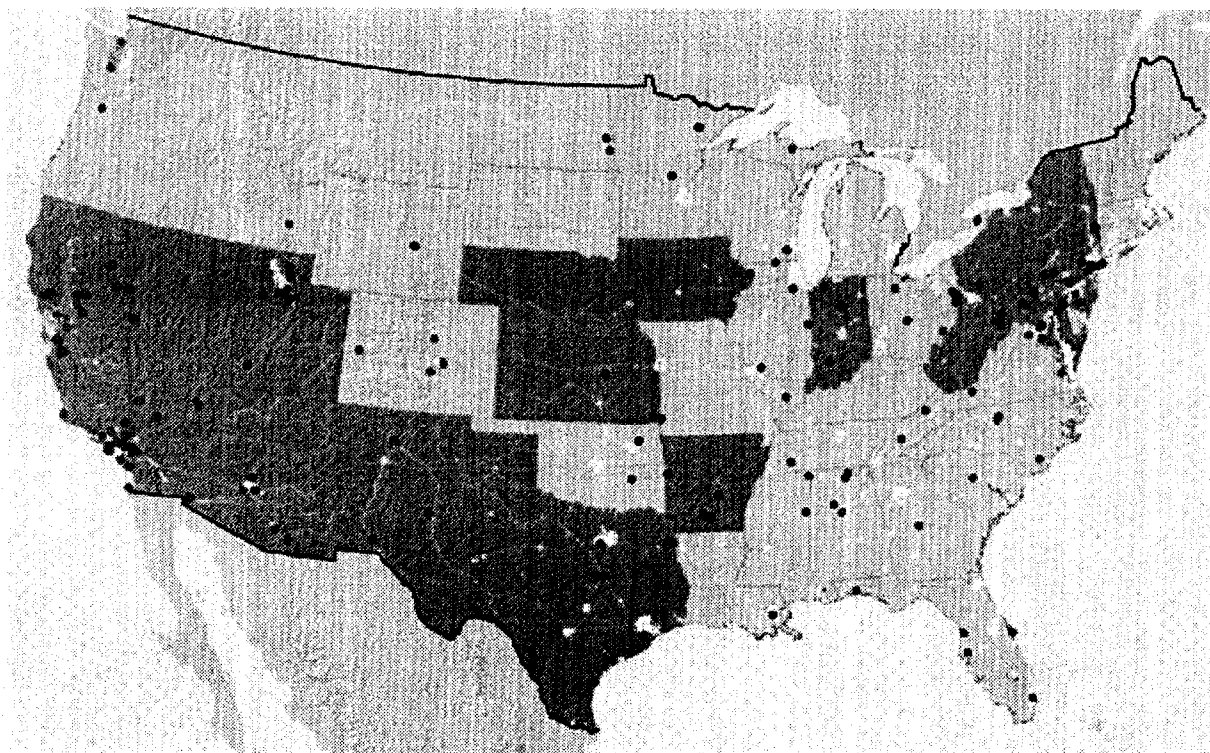
Although it will not be mandatory to collect perchlorate data until EPA's unregulated contaminants monitoring rule takes effect next year, EPA nonetheless has collected some data from most of the country, said Kevin Mayer, the project manager from EPA's Region 9, who has been compiling this data (see map, [Where perchlorate was used, and where it has been found](#)). He acknowledged that he regularly learns about new sources of potential contaminations such as the compound's use in research universities—that require investigation nationwide. —KELLYN S. BETTS

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Where perchlorate was used, and where it has been found



On this map, sites where perchlorate was manufactured and used by the military and aerospace industry are marked in red. States that have reported perchlorate contamination to EPA are highlighted in blue. Although the compound was used throughout the southeast, little information about detections there has been passed along to EPA, according to Region 9. Source: EPA

- Perchlorate sites
- U.S. interstates
- Reported releases
- No known releases
- ░ Urbanized areas

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